



A **DOVER** COMPANY

Automation
Robohand FERGUSON
CAMCO

INSTALLATION & SERVICE MANUAL ED & PINNACLE SERIES DRIVES

WARNING

This is a controlled document. It is your responsibility to deliver this information to the end user of the CAMCO or FERGUSON product. Failure to deliver this could result in your liability for injury to the user or damage to the machine. For copies of this manual, call your Customer Service Representative at 800-645-5207

INTRODUCTION

This manual is supplied to aid in the installation and maintenance of your Ferguson index drive.

When contacting Industrial Motion Control, please have the serial number of your unit available. This number can be found on the serial number tag.

To determine the model number and the ratio of a Ferguson reducer, refer to the tag which is located on the reducer housing. If the reducer is by another manufacturer, refer to that manufacturer's nametag located on the reducer housing.

Unit configurations, reducer mounting positions, and hand of cam nomenclature can be found inside the back cover of this manual. These will aid in describing your unit.

Industrial Motion Control provides factory rebuild or repair services at our centrally located Wheeling, Illinois facility. Industrial Motion Control can also provide technicians or engineers for field service calls worldwide.

If you have any questions or problems, please feel free to contact our Customer Service Department, or the Technical Sales Department at:
1-800-645-5207 or 1-847-459-5200, FAX: 1-847-459-3064,
or EMAIL: **techservice@camcoindex.com.**

If you need to contact a sales representative in your area, you can log on to our web site: www.camcoindex.com and go the section labeled "Find a local Rep" to find the sales office that is nearest to you.

At Industrial Motion Control, it is our policy to provide the highest quality products that meet or exceed our customer's requirements. In order to achieve this commitment, Industrial Motion Control has documented its policies and procedures to be in compliance with ISO-9001.

Table of Contents

<u>Section</u>	<u>Page</u>
1. General Information	2-4
1.1. Warranty	2
1.2. Safety	2,3
1.3. Operating Environment	3
1.4. Ordering Replacement Parts	3
1.5. Requesting Service	4
1.6. Returning a Unit for Repair	4
2. Overview	5-8
2.1. ED200 Series Location Map & Parts List	5
2.2. ED and PN Series Location Map & Parts List	6
2.3. PN400/PN500 w/Internal Overload Clutch Location Map & Parts List	7
2.4. Ferguson Reducer Location Map & Parts List	8
3. Specifications	9
4. Installation	10
4.1. Unit Installation	10-12
4.2. RT6-D Rite Torq® Limiting Clutch Installation	13-18
5. Adjustments	19-25
5.1. Internal Clutch	19
5.2. Prox Switch	20,21
5.3. FSC...Ferguson Slip Clutch	22-25
6. Maintenance	26
6.1. Using Correct Lubricants	26
6.2. Changing Oil	26
7. Troubleshooting	27,28
8. Repair and Replace	29-37
8.1. Cam Follower Replacement - Models ED90, ED91 & ED200	29
8.2. Cam Follower Replacement - Models PN300 thru PN500, ED420 thru ED3240	29
8.3. Oil Seal Replacement	33,34
8.4. Reducers	34-37
9. Things to Avoid	38,39
REFERENCE: Unit configurations, Reducer Mtg Positions, Hand of Cam Drawing	40

SECTION 1: General Information

Industrial Motion Control (IMC) Index Drives are engineered and manufactured to very high tolerances which necessitate careful inspection and maintenance.

Some users of indexing drives have the facilities and trained personnel to accomplish service repair. You must determine the extent to which intricate servicing should be done in your own facility. When in doubt, IMC recommends that IMC trained servicemen make the repairs.

1.1. **Warranty** - Products are warranted as follows:

- 1.1.1. Our products are warranted for one (1) year from the date of shipment to be free from defects in workmanship and materials. The foregoing warranty is exclusive and in lieu of all other warranties, whether written or orally expressed or implied and there are no warranties of merchantability or fitness for particular use.
- 1.1.2. Our obligation under the foregoing is limited to replace free of charge, including the lowest transportation cost, but not including installation or any other charges, any part that our inspection shows to be defective provided that the part was properly installed, suitably maintained and not subject to misuse or abuse, and further provided that the defective parts are returned to our plant within one (1) year after delivery by us. Written permission for such return must first be obtained from IMC. A complete explanation is required of the alleged defects and circumstances.

1.2. **Safety** – Read and follow all **Warnings** and **Cautions** prior to any service or repair.

- 1.2.1. Roller Gear Drives should not be started and stopped at high speed during the transfer phase of the cams. This can cause serious damage to the Indexer and reduce the cam follower life. **For cycling during setup or jog mode, speed must be reduced to 25% of the normal operating speed.** The use of an E-stop for purposes other than emergencies is not recommended. A cycle stop button should be incorporated into the system controls. Please consult Industrial Motion Control's Wheeling factory for additional information.
- 1.2.2. Always disconnect power and lockout the source before working on these units.
- 1.2.3. All input and output connections should be backlash free. Use friction lock type shaft couplings such as taper lock bushings, split and clamped hubs, etc., in the input and output drive train. There should be no loose keys, set screws, etc.

SECTION 1: General Information (continued)

- 1.2.4. Reducers should be of minimum backlash variety and directly coupled with backlash-free connection. If line shafts are used, they must be sized for severe reversing loads.
- 1.2.5. When using chain or belt drives, incorporate an idler to eliminate any slack.
(Do not use spring-loaded idlers.) As the cam motion stops and starts, any slack in the chain changes sides. It is necessary to maintain a constant speed of the input shaft. Loose belts or chains will cause inertial over-run, causing distorted acceleration and deceleration characteristics which may cause damage to the unit. Belts and chains must be sized for severe reversing loads.
- 1.2.6. Industrial Motion Control does not provide guarding for other moving parts, such as dials, handwheels, switch cams, etc. Numerous pinch points do exist on this equipment and the possibility exists of being struck by a moving part. Since this product is expected to become part of a further developed machine, it is the customer's responsibility to add safety fencing, guarding, light curtains or other protection devices, as necessary, to protect personnel and property.

NOTE: In the event the unit is damaged, contact Industrial Motion Control's Wheeling factory or your local representative, for proper reconditioning or repair (see sections 1.5 Requesting Service or 1.6 Returning a Unit for Repair).

- 1.3. **Operating Environment** – This machine is intended to operate in a clean environment. Excessive coolant, chips, dust dirt or debris can adversely affect its performance and life. If this machine does operate in a dirty environment periodic cleaning must be practiced and careful inspection of seals and accessories is necessary.
 - 1.3.1. For extended storage, remove vents and fill with proper oil. (Refer to Section 6)
- 1.4. **Ordering Replacement Parts** – When ordering parts, always provide the following information:
 - 1.4.1. The serial number shown on the nameplate.
 - 1.4.2. The part name and/or the description listed in the manual.
 - 1.4.3. The part numbers shown on the bill of material or assembly drawings.

SECTION 1: General Information (continued)

- 1.5. Requesting Service** – Call our Technical Service Department in Wheeling, IL at 1-800-645-5207 or 847-459-5200 between 8:00AM and 4:00PM CST. When requesting service, always provide the following information:

- 1.5.1. The serial number shown on the nameplate. (Refer to Inside Front Cover)
- 1.5.2. A clear description of the problem, including as much detail as possible of the circumstances leading up to the problem.

- 1.6. Returning a Unit for Repair** – Please contact the Repair Department in Wheeling, Illinois at (847) 459-5200 for a "Return Material Authorization" Number (RMA#).

The following information is required of a unit for repair, conversion or warranty.

- 1. Purchase order number
- 2. Customer name
- 3. Customer billing address
- 4. Customer shipping address
- 5. Person to contact, upon inspection, with delivery and price.
- 6. Telephone number
- 7. Model number (located on name plate)
- 8. Serial number (located on name plate)
- 9. Description of defects, problems or circumstances.

The IMC Repair Department will assess repairs by phone and estimate inspection fees or repair costs.

Non-warranty inspection fees will vary depending on the size of the unit and optional equipment mounted. These fees apply only if customer decides not to repair or replace subject unit.

Please return IMC equipment only (remove sprockets, pulleys, etc). This will reduce the amount of disassembly time (saving customer cost on labor) and will provide faster evaluation for quoting price and delivery of repair or conversion. Oil must be drained before shipping.

Package unit to protect it from weather or damage during shipping. Place the (RMA#) on the outside of the packaging for prompt service.

Ship Warranty units via surface freight collect. Ship Non-Warranty units to IMC transportation prepaid. IMC will not accept collect shipments on non-warranty repairs

Ship to: Industrial Motion Control, LLC
1444 South Wolf Road
Wheeling, Illinois 60090 - USA

SECTION 2: Overview

The sketches contained in this document are for illustrative purposes only. They are not intended to accurately represent the components and therefore are not to scale. The various models may be different than shown, depending upon options chosen or the particular configuration of a unit.

2.1. ED200 Series (only) Location Map

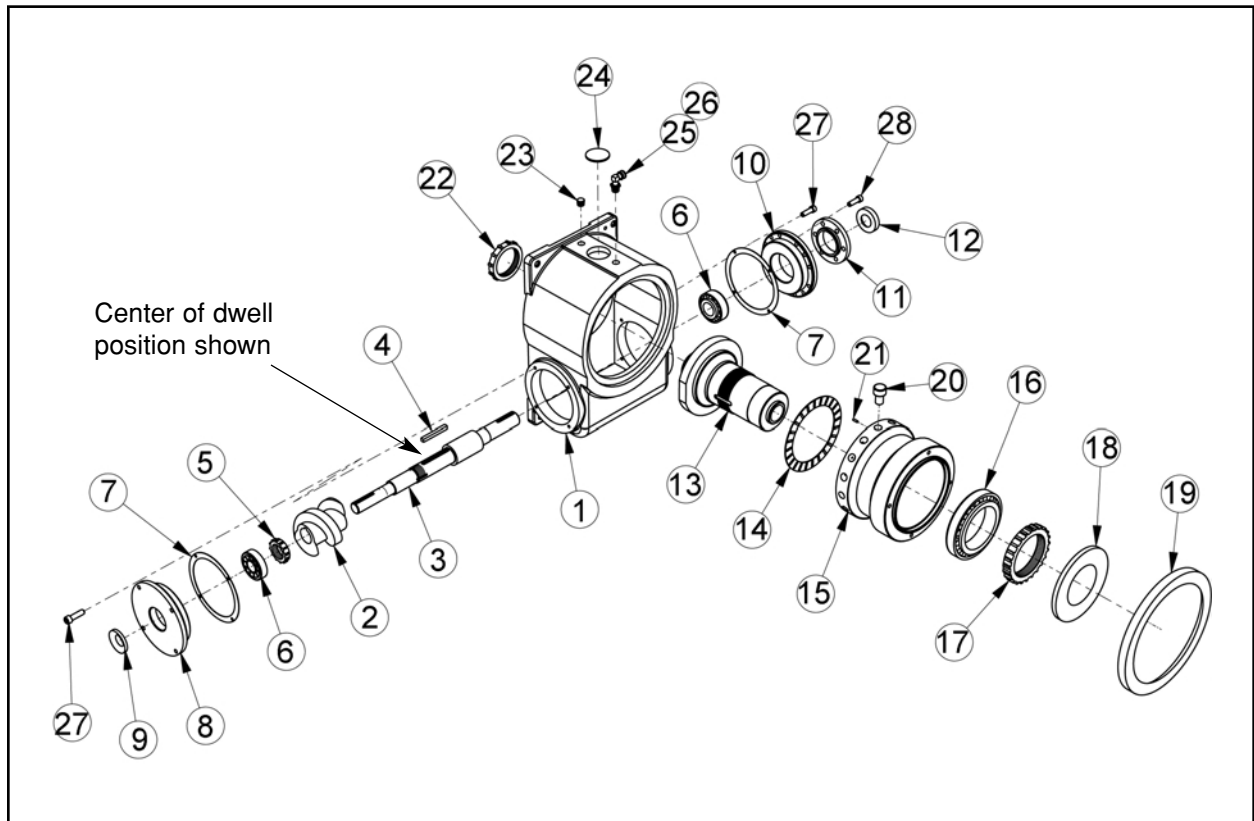


FIGURE 1

ED200 Series Parts List

- | | |
|---------------------------------|----------------------------|
| 1. Housing | 15. Roller gear shaft |
| 2. Cam | 16. Tapered roller bearing |
| 3. Cam shaft | 17. Locknut and washer |
| 4. Cam shaft key | 18. Oil seal |
| 5. Locknut & washer | 19. Oil seal |
| 6. Tapered roller bearing | 20. Cam followers |
| 7. Shim set | 21. Cone point set screws |
| 8. Bearing cap | 22. Locknut and washer |
| 9. Oil seal | 23. Pipe plug |
| 10. Bearing cap (reducer side) | 24. Oil site glass |
| 11. Bearing retainer & seal cap | 25. Oil sump vent |
| 12. Oil seal (reducer side) | 26. Bushing |
| 13. Eccentric center tube | 27. Cap screws |
| 14. Thrust bearing | 28. Cap screws |

SECTION 2: Overview (continued)

2.2. ED & PN Series Location Map

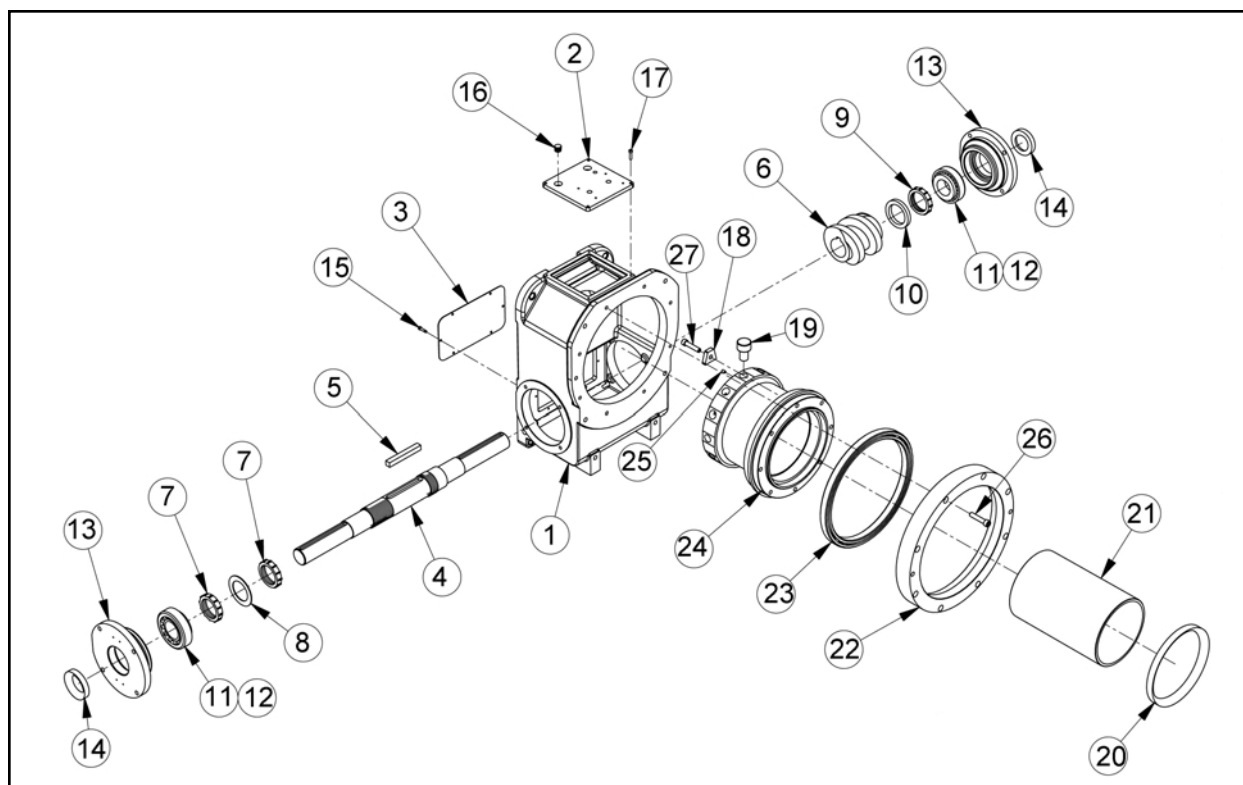


FIGURE 2

ED & PN Series Parts List

- | | |
|-------------------------------|-----------------------|
| 1. Housing | 15. Cap screws |
| 2. Access cover | 16. Pipe plug |
| 3. Cam cover plate | 17. Cap screws |
| 4. Cam shaft | 18. Bearing clamp |
| 5. Key | 19. Cam followers |
| 6. Cam | 20. Top seal |
| 7. Locknut | 21. Center tube |
| 8. Lockwasher | 22. Bearing ring |
| 9. Locknut | 23. Output shaft seal |
| 10. Lockwasher | 24. Output shaft |
| 11. Timken bearing cup | 25. Locking set screw |
| 12. Timken bearing cone | 26. Cap screw |
| 13. Cam shaft bearing carrier | 27. Cap screw |
| 14. Oil seal | |

SECTION 2: Overview (continued)

2.3. PN400 and PN500 Series with Internal Overload Clutch Location Map

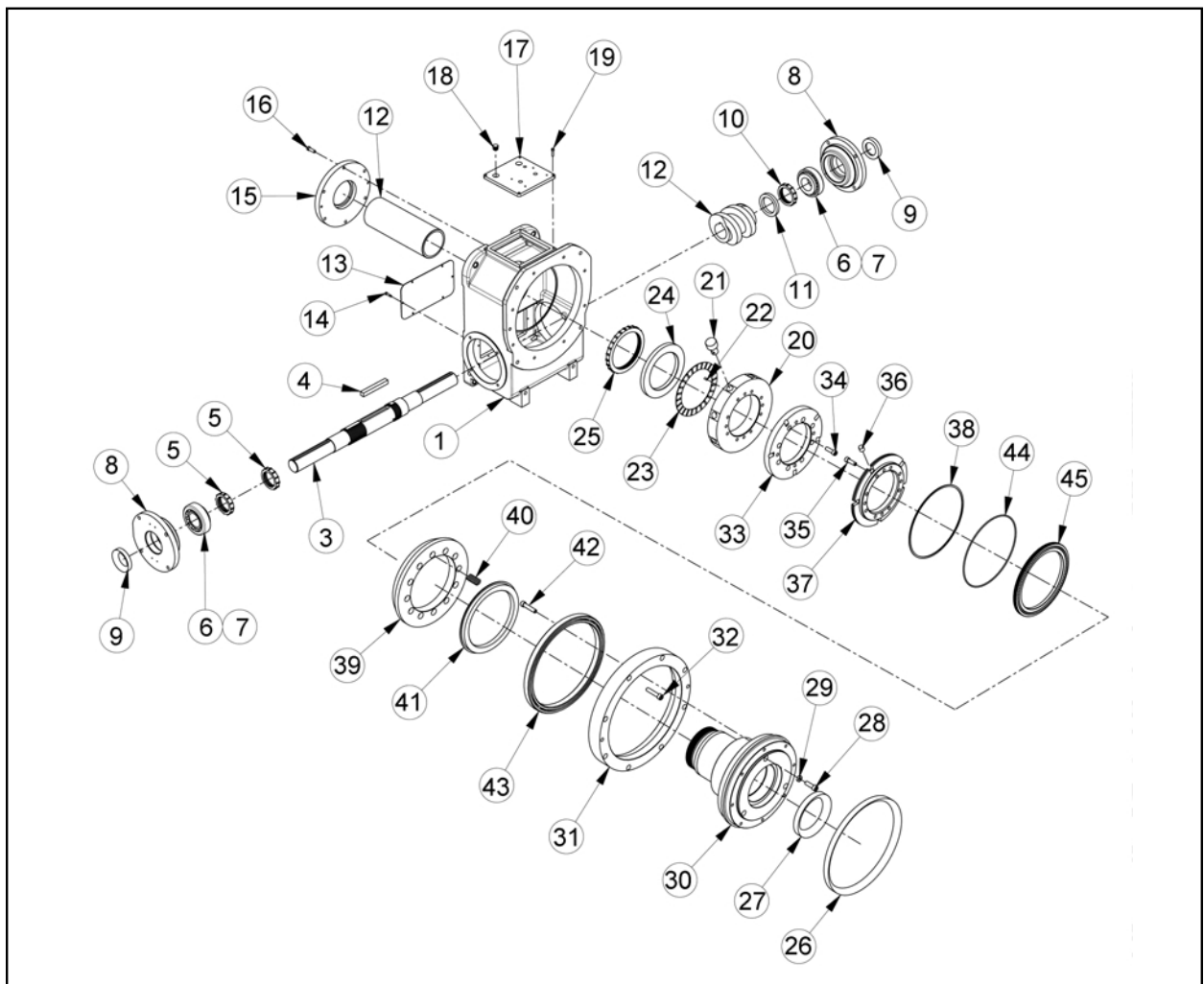


FIGURE 3

PN400 and PN500 Series with Internal Overload Clutch Parts List

- | | | |
|----------------------|--------------------------|---------------------------|
| 1. Housing | 16. Cap Screws | 31. Bearing Plate |
| 2. Cam | 17. Access Cover | 32. Cap Screws |
| 3. Camshaft | 18. Vent | 33. Detent Seat Ring |
| 4. Camshaft Key | 19. Cap Screws | 34. Dowels |
| 5. Locknuts | 20. Cam Follower Hub | 35. Cap Screw |
| 6. Timken Cup | 21. Cam Followers | 36. Rollers |
| 7. Timken Cone | 22. Locking Set Screws | 37. Retainer Ring |
| 8. Bearing Cap | 23. Thrust Bearing | 38. "O" Ring |
| 9. Seal | 24. Thrust Bearing Plate | 39. Ring/Pressure Switch |
| 10. Locknut | 25. Locknut | 40. Springs |
| 11. Spacer | 26. Seal | 41. Spring Adjusting Ring |
| 12. Tube | 27. Seal | 42. Cap Screws |
| 13. Housing Cover | 28. Cap Screws | 43. Bearing Clamp |
| 14. Cap Screws | 29. Shim Set | 44. "O" Ring |
| 15. Center Tube Ring | 30. Roller Gear Shaft | 45. Ring Bearing |

SECTION 2: Overview (continued)

2.4. Ferguson Reducer Location Map

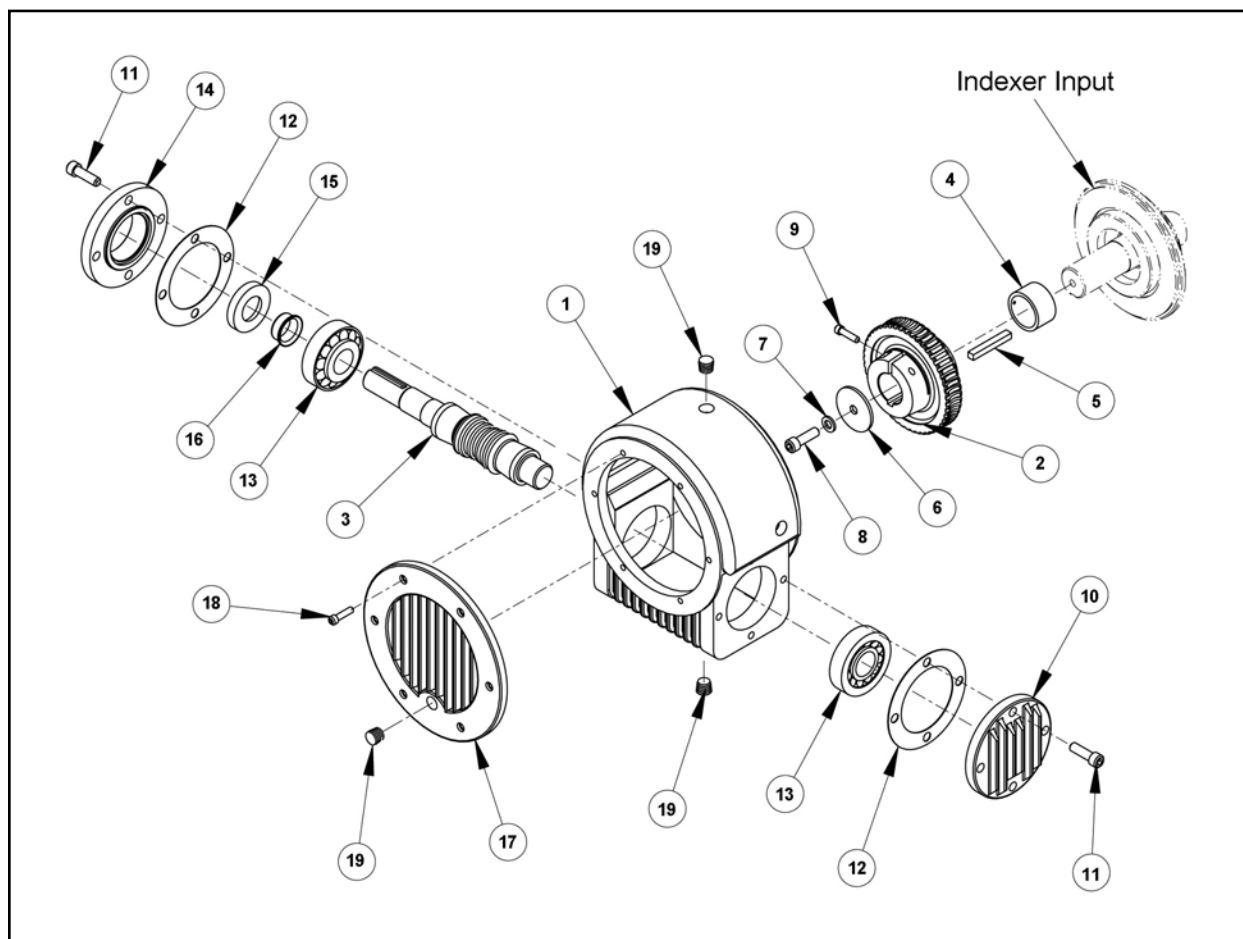


FIGURE 4

Ferguson "R" Series Reducer Parts List

- | | |
|--|--------------------|
| 1. Housing | 10. Closed End Cap |
| 2. Ring Gear (& separate hub for some units) | 11. Cap Screws |
| 3. Pinion Worm Gear | 12. Shim Pack |
| 4. Gear Spacer | 13. Timken Bearing |
| 5. Key for Indexer Shaft | 14. Open End Cap |
| 6. Arrestor Washer | 15. Oil Seal |
| 7. Lockwasher | 16. Wear Sleeve |
| 8. Cap Screw Keeper | 17. Cover Plate |
| 9. Cap Screw for Clamping Hub | 18. Cap Screws |
| | 19. Oil Plugs |

SECTION 3: Specifications

Model	Standard Reducer	Standard AC Motor With Air Clutch/Brake	Standard 90 V DC Motor (Max HP)	Output Shaft Torque Limiter	Input Shaft Torque Limiter	Lubrication Capacity Main Oil Sump (Gallons) ³	Lubrication Capacity Gear Reducer	Unit Weight (LBS) ²	Unit Weight with Reducer (LBS) ²	Unit Weight with Motor/Reducer Pkg. (LBS) ²
PN300	R175	IEC71-B14 w/1/3 HP	1/3 HP	RT6D	N/A	1	1 QT.	50	N/A	65
ED200	R200	MDB625 w/1 HP	1/2 HP	DTL10	R2.5 FSC	1.5	1.5 QTS.	300	N/A	325
PN400	926CDSS	MD625 w/1/2 HP	1/2 HP	4	N/A	2	1.5 QTS.			
PN500	930CDSS	MD625 w/1 HP	1 HP	4	N/A	3	2 QTS.			
ED420	R300	MDB875 w/2 HP	1-1/2 HP ¹	N/A	R3FSC	5	2.5 QTS.	750	789	850
ED810	R400	MDB875 w/2 HP	2 HP ¹	N/A	R4FSC	20	1.5 GAL.	1200	1275	1325
ED1440	R600	MDB1125 w/5HP	N/A	N/A	R6FSC	30	3.7 GAL.	3000	3235	3455
ED3240	R700	N/A	N/A	N/A	R7FSC	35	6.5 GAL.	9500	9780	N/A

CHART 1

¹ 180 V.DC.

² Weights are approximate, less crating.

³ Refer to section on lubrication for specifications of lubricants. Amounts are approximate for standard HM-1 position only. Actual capacities may vary by other mounting positions or drive codes. Always check oil level site glass or plugs before topping off or refilling.

⁴ Has optional internal overload clutch.

SECTION 4: Installation

These units are manufactured to meet a specific set of design parameters. Any change to the load, dials, or speed of the camshaft may require a size change. No change can be made without affecting other performance characteristics of the unit and, therefore, should not be done without consulting the factory.

4.1. To install the unit:

4.1.1. Rotate camshaft so cam is in center of dwell (see figure 5 and 6).

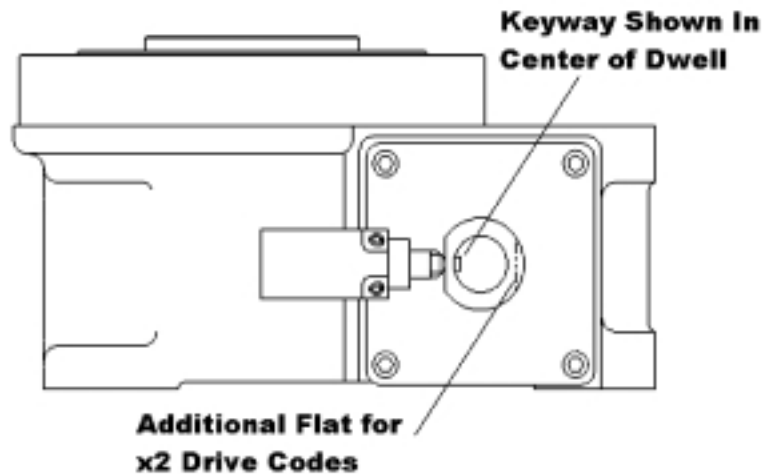


FIGURE 5 - PINNACLE SERIES

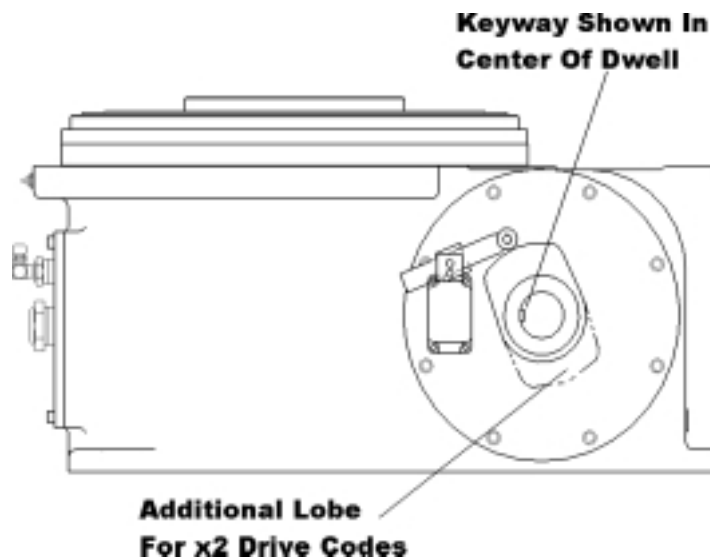


FIGURE 6 - ED SERIES

SECTION 4: Installation (continued)

- 4.1.2. Mount the Indexer into position on a rigid base and secure with the largest size bolts that will fit through the mounting holes.
- 4.1.3. Align the Indexer with respect to the station positions before tightening bolts and doweling. Use a dial indicator or other appropriate tool to insure alignment.
- 4.1.4. Tighten all mounting bolts securely and uniformly.
- 4.1.5. Install dowels.
 - 4.1.5.1. Use a commercially available straight dowel of the appropriate size.
 - 4.1.5.2. Drill a hole into the base to a depth of at least 1-1/2 times the diameter of the dowel. Use a drill the same size as the pilot hole in the Indexer housing.
 - 4.1.5.3. Line ream housing and base for press fit with dowel pin.
 - 4.1.5.4. Install dowel pins into position. Leave some material exposed to facilitate removal in the future, or use threaded dowel pins.
- 4.1.6. Check the oil level of the sump and gear reducer prior to operating the unit.
 - 4.1.6.1. Pay particular attention if the oil level is too high. If a unit has been idle for some time since its manufacture, condensation may be present. If condensation is noticed, the oil should be drained, the unit thoroughly cleaned and re-filled with oil (see Chart 1 in Section 3 for capacities).

NOTE: If shot pins or guide pins in dies are used, the unit should have been manufactured with a dwell relief in the cam. If severe vertical loads exist, an anvil may be required. Tangential loads may require the use of a shot pin or dial clamp. For further information, consult your local Industrial Motion Control Representative or the Technical Sales Department at 1-800-645-5207 or 847-459-5200.

- 4.1.6.2. The unit's sump must be filled with SAE 90 EP Gear oil or equivalent meeting MIL-PRF-2105E and API Service Classification GL5 or GL6 before operation (see Chart 1 in Section 3 for capacities). An example of this oil is Mobilube HD 80W-90. For extreme applications, use Mobilube HD 85W-140 (consult your local representative to determine if your application is extreme).

SECTION 4: Installation (continued)

- 4.1.6.3. Bronze Gear Reducer oil must be SAE140 Steam Cylinder Oil meeting AGMA #8 Compound, MIL SPEC, MIL-L-15016A; symbol 3150 (see Chart 1 in Section 3 for capacities). (Or manufacturer's specified oil if not an Industrial Motion Control manufactured reducer.)
- 4.1.6.4. Be sure optional controller is properly fused – refer to vendor's manual.
- 4.1.7. Check the adjustment of the Switch cam if your unit has this option. To insure unit stops in dwell, see Figures 5 and 6.
 - 4.1.7.1. A standard roller gear indexer shown in Figure 5 with a Brake Cam & Limit Switch shown with the keyway in the center of the dwell period. It is necessary to phase the Brake Cam such that the input shaft of the indexer stops during the dwell period of the index cycle while leaving enough of the dwell period for the input shaft to accelerate to full speed before leaving the dwell period.
 - 4.1.7.2. If the indexer has a drive code which causes multiple indexes per camshaft revolution (i.e. X2, X3, etc... drive codes), additional lobe(s) on the Brake Cam are required. The lobes will be equally spaced. Therefore, phasing the one lobe of the Brake Cam to one dwell period on the indexing cam will, in most cases, cause the other lobes to be correctly phased with the other dwell periods.

NOTE: The lobes on the Brake Cam of PN series indexers are formed by removing material from a shaft collar rather than a protruding lobe. This will make a difference in the setup of the limit switch and the control.

NOTE: Controllers are normally shipped loose and brake cam / limit switches are mounted to the unit. However, neither are set or adjusted at the factory. Limit switch and cam must be set to initiate the stopping cycle. Controller must be set for the load & speed of the application per instruction in the vendor's manual.

NOTE: The switch and brake cam commonly provided to initiate the stop cycle cannot be used to indicate "on station." A second switch and brake cam should be ordered for this purpose.

SECTION 4: Installation (continued)

4.2. RT6-D Rite Torq® Limiting Clutch

NOTE: The RT6-D is designed to be used with only the Ferguson PN300 Indexer and maintains the same dial height. Other Torque Limiters are available for various applications. Call Industrial Motion Control Technical Support at 1-800-645-5207 or 847-459-5200 for assistance.

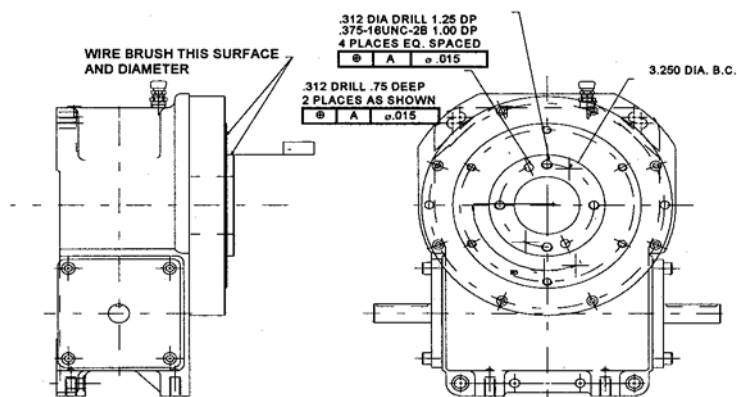
If the clutch on the PN300 unit is a RT6-DF, the dial mounting instructions shown below do not apply since the dial is installed "over" the clutch to an external mounting flange. The RT6-DF clutch raises the dial mounting height by 1/2 inch, and requires a different pilot diameter, bolt hole pattern.

The RT6-D clutches should be protected for use in extremely "humid" environments or "wash down" applications.

WARNING: FERGUSON RT6-D AND ALL INDUSTRIAL MOTION CONTROL COMPANY TORQUE LIMITERS ARE ONLY FOR THE PROTECTION OF THE INDEXER. THE TORQUE LIMITER IS NOT FOR USE AS A HOLDING OR OVERHAULING "FAIL SAFE" DEVICE TO PROTECT AGAINST BODILY INJURY.

4.2.1. Prepare PN300 Indexer for mounting RT6-D

NOTE: This step has been finished at factory if the clutch was ordered with the Indexer.



PN300 PREPARED FOR RT6 CLUTCH MOUNTING

FIGURE 7

SECTION 4: Installation (continued)

- 4.2.1.1. Position Indexer in a dwell period of the cam (input keyway positioned as in Figure 7 when unit is in center of dwell).
- 4.2.1.2. Drill and tap (4) mounting holes and (2) drilled holes into output of Indexer as shown in Figure 7.
- 4.2.1.3. Rotary wire brush surfaces indicated to burnish - in bearing surfaces.
- 4.2.2. Mount driven detent plate to dial.

NOTE: If dial has premachined station holes which must hold a relationship to Indexer, verify position before following these steps.

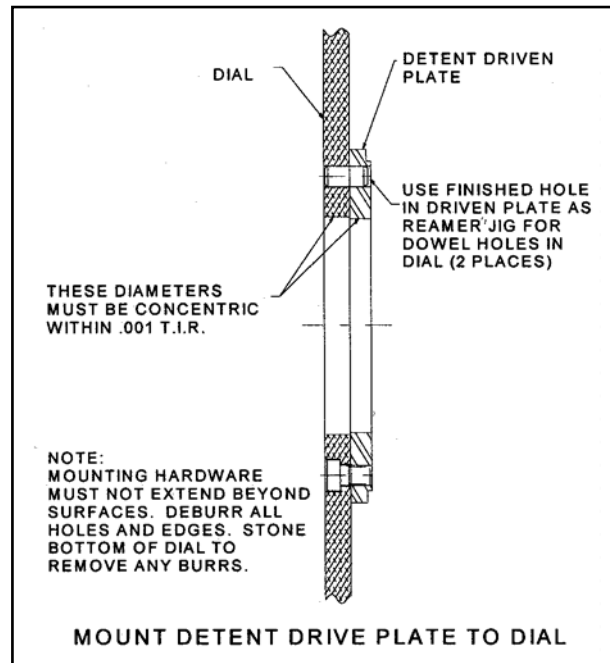


FIGURE 8

- 4.2.2.1. Mount the driven detent plate of the clutch to the dial and transfer the four 3/8 capscrew holes and two .375" diameter dowel holes. See Figure 8.
- 4.2.2.2. Maintain a concentricity of .001" TIR, as indicated between the bores in both pieces.

SECTION 4: Installation (continued)

- 4.2.2.3. Ream the dowel pin holes for a press fit using the hardened detent plate as a guide for the reamer.
- 4.2.2.4. Assemble the driven detent plate to the dial with four 3/8-16 capscrews and two .375" diameter dowel pins. Check that the fasteners do not protrude on either side of the assembly. (Apply Loctite #242 Threadlocker to capscrews.)

4.2.3. Shimming RT6-D

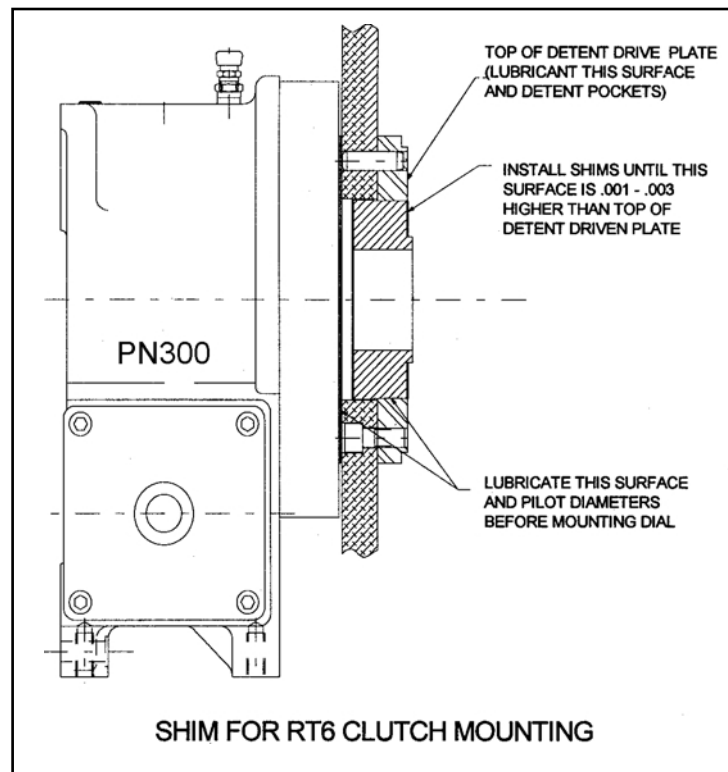


FIGURE 9

- 4.2.3.1. Coat the Indexer dial mounting surface and pilot with Molykote™ Grease and mount the clutch adapter and dial/detent plate assembly. (See Figure 9).
- 4.2.3.2. Rotate dial while applying downward pressure to level out excess grease.
- 4.2.3.3. Measure the height difference between the top of the detent driven plate and the top of the clutch adapter. Install shims as required to raise adapter surface .001 - .003 above top of detent driven plate. This will ensure that the dial will rotate freely with minimum clearance.
- 4.2.3.4. Coat top of detent driven plate and detent pockets with Molykote™ Grease.

SECTION 4: Installation (continued)

4.2.4. Clutch Assembly

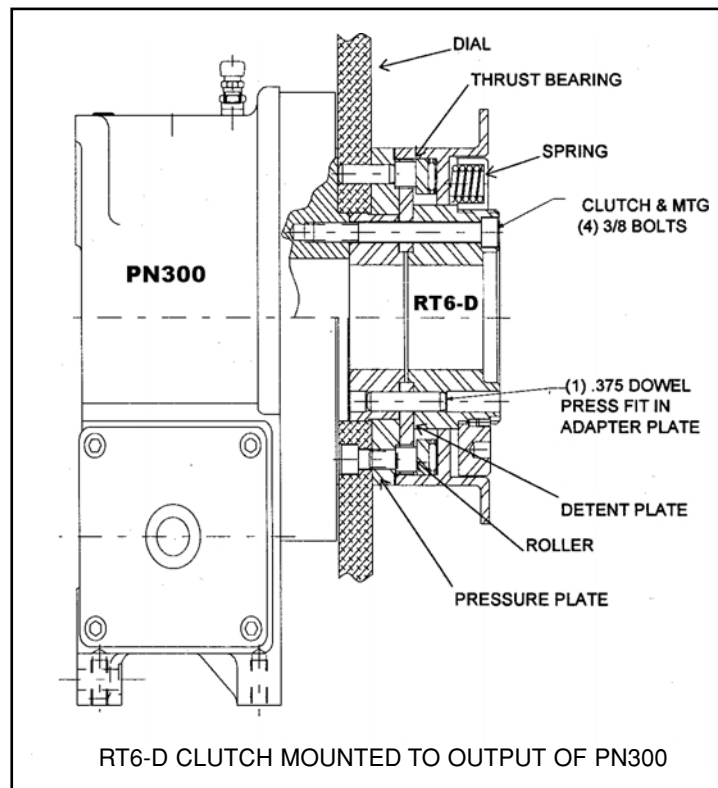


FIGURE 10

- 4.2.4.1. Assemble remaining RT6-D clutch parts to PN300 unit as shown in Figure 11 being careful to correctly align mounting holes in adjacent parts and rotating dial to cause all rollers to seat into a detent pocket. Coat thrust bearing and rollers with grease. (See Figure 10).

NOTE: Some parts have additional holes for use on other applications. If dial plate has station holes, verify correct location at this point.

- 4.2.4.2. Lightly snug (4) 3/8 clutch mounting bolts. Install (1) .375 dowel into pre-machined hole to align clutch parts. Tighten clutch bolts securely.

SECTION 4: Installation (continued)

4.2.5. Dowel Clutch Adapter to PN300 Output

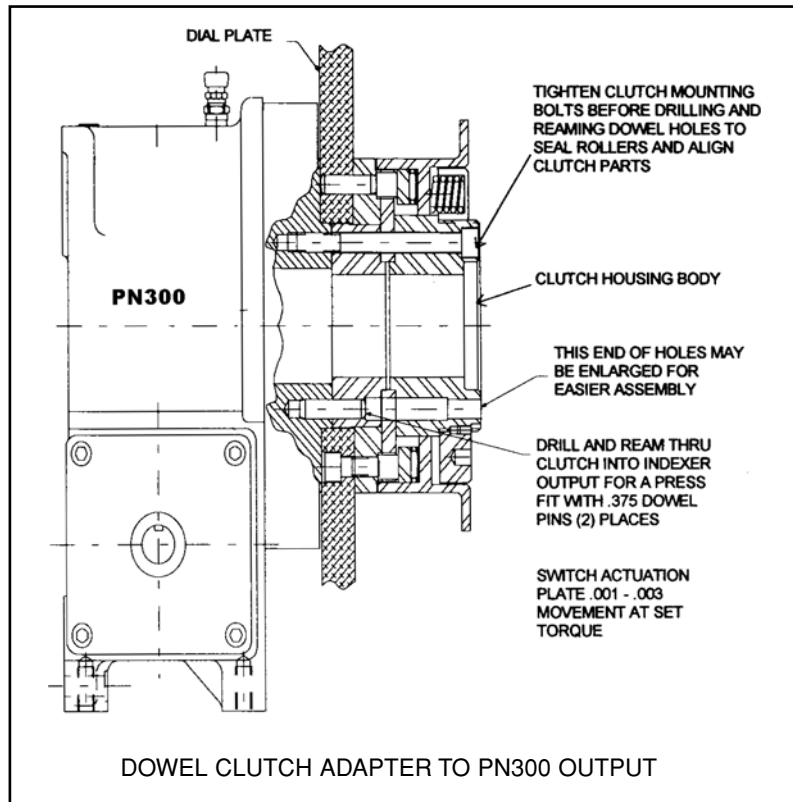


FIGURE 11

- 4.2.5.1. Drill and ream through clutch into Indexer output at (2) drilled holes put into Indexer in Step 1b for a press fit with .375 diameter dowel pins (2) places. (See Figure 11)

NOTE: Holes in clutch housing body will have one end machined for press fit with dowels for another application. End of hole may be enlarged with a clearance drill for easier assembly.

WARNING: IF REQUIRED, DISASSEMBLE RT6-D AND CLEAN ALL PARTS TO REMOVE METAL CHIPS AND BURRS. CLUTCH IS NOT SEALED, AND METAL CHIPS, ETC., BETWEEN ROTATING PARTS CAN CAUSE CLUTCH TO FAIL.

CHECK OPERATION OF CLUTCH BY MANUALLY ROTATING THE DIAL TO TRIP THE CLUTCH AND RE-ENGAGE IT IN BOTH DIRECTIONS.

SECTION 4: Installation (continued)

- 4.2.6. The set or trip torque can be checked by adapting a torque wrench or spring scale to the dial. Set torque should be within +/-15% of the started value.

NOTE: Set torque is defined as the torque which causes the first .001/.003" movement of the rollers out of the detent. This can be checked with a dial indicator on the switch actuation plate.

The trip torque (to cause a complete disengagement of the clutch) will be up to 30% higher than the set torque (initial movement).

- 4.2.7. Disassembling clutch for maintenance

- 4.2.7.1. Remove the dowel between the clutch body and output adapter. Do not remove the dowel pins between the output adapter and indexer. Do not disassemble the spring adjusting nut from the clutch housing body.
- 4.2.7.2. Carefully unfasten and remove clutch bolts so that the body mounting is released slowly to prevent bodily injury.
- 4.2.7.3. Remove the clutch body assembly from output adapter.
- 4.2.7.4. Clean off any contaminants or residues and inspect all parts for any wear.
- 4.2.7.5. Apply Molykote™ grease to detent driven plate, detent pockets, rollers and bearings. Reassemble clutch.

SECTION 5: Adjustments

As noted in the introduction, the Roller Gear Drive is a solid mechanical, backlash-free mechanism. There are no adjustments required on the Indexer during installation unless it is furnished with a torque limiting device or a motor drive package equipped with speed control. After the Indexer has been installed and set up with the users' load in place it will be necessary to check these items for proper adjustment & settings.

NOTE: Drive should be in center of dwell and dowel pinned to base before installing accessories, as previously mentioned in 4.1.1 and 4.1.5.4.

5.1. Internal Torque Limiters – ED250, PN400 and PN500

- NOTE:
1. Drive should be in center of dwell and dowel pinned to base before installing accessories.
 2. Customer's dial must have access holes to adjusting screws.
 3. Torque Limiter comes in three available ranges, as shown below.
Maximum torque for range ordered is stamped on face of output shaft.

5.1.1. To adjust clutch to final required setting after installing load, turn the (3) torque adjusting screws using a .312" Allen wrench, evenly in 3 turn increments. Turn clockwise to increase torque and counterclockwise to decrease torque.

5.1.2. Clutch proximity switch with 2-meter cable must be adjusted for proper operation.

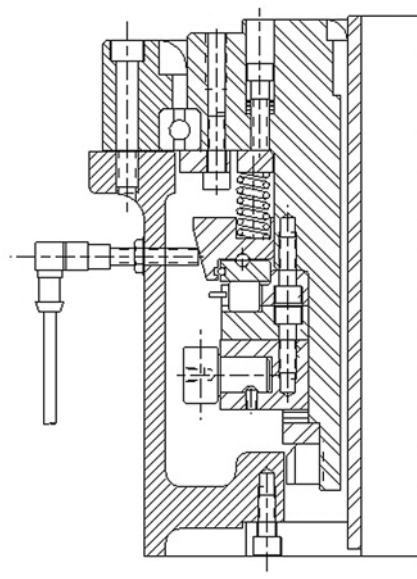


FIGURE 12

PN500 INTERNAL CLUTCH TORQUE RANGE OPTIONS	
HIGH RANGE	7,000 to 14,000 IN-LBS approx. adjustment range (3,300 IN-LBS per turn)
MED RANGE	5,500 to 11,000 IN-LBS approx. adjustment range (2,450 IN-LBS per turn)
LOW RANGE	3,600 to 7,350 IN-LBS approx. adjustment range (1,650 IN-LBS per turn)

SECTION 5: Adjustments (continued)

5.2. Prox Switch Adjustments

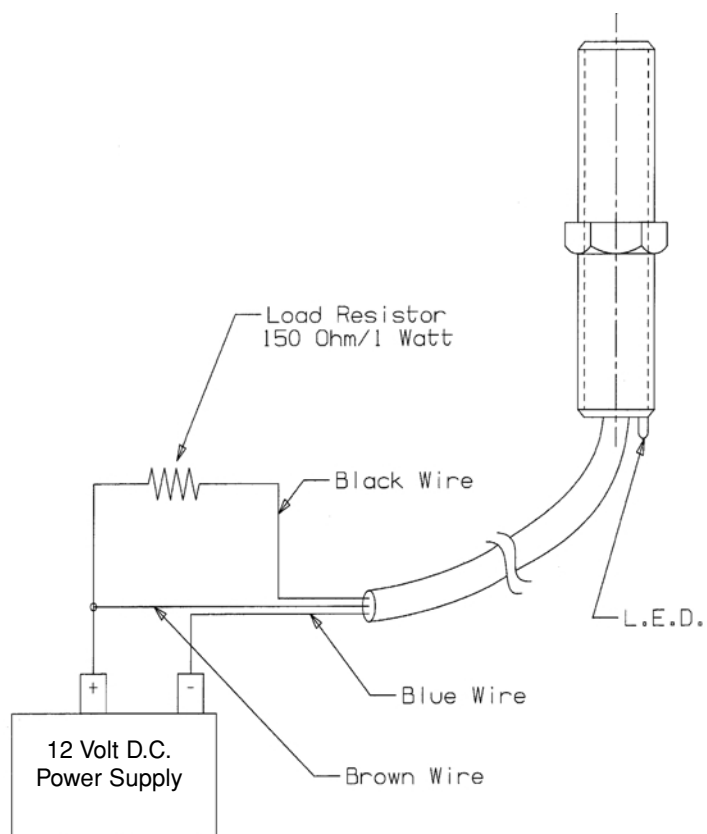


FIGURE 13

5.2.1. Internal Clutch Trip Detection Prox Switch

- 5.2.1.1. Screw the prox switch into the unit until its face just touches the detection plate (the angular surface visible through the prox switch hole). The L.E.D. on the end of the switch should now be lit.
- 5.2.1.2. Screw the prox switch out until the L.E.D. goes out. Next, screw the switch in again until the L.E.D. lights, and then turn approximately 1/4 turn more. Rotate the output shaft a full revolution, the L.E.D. should always remain on. Be sure the end of the prox switch does not contact the detection plate.

SECTION 5: Adjustments (continued)

- 5.2.1.3. Trip the internal clutch, the L.E.D. should now go off. Repeat this process several times making a full revolution of the output, the L.E.D. must go off consistently when the clutch is tripped and light when the clutch is reset.

NOTE: The detection switch set up procedure is appropriate for the Industrial Motion Control (Turck) part numbers listed below. If your equipment has another model number or is from another manufacturer, contact the switch manufacturer for set up procedures.

Industrial Motion Control PN 1000000938 (Turck # Bi 1-G08-AN6X)

Industrial Motion Control PN 1000000939 (Turck # Bi 2-G12-AN6X)

Industrial Motion Control PN 1000003115 (Turck # Bi 1-G08-AN6X-H1341)

SECTION 5: Adjustments (continued)

5.3. FSC... Ferguson Slip Clutch Location Map

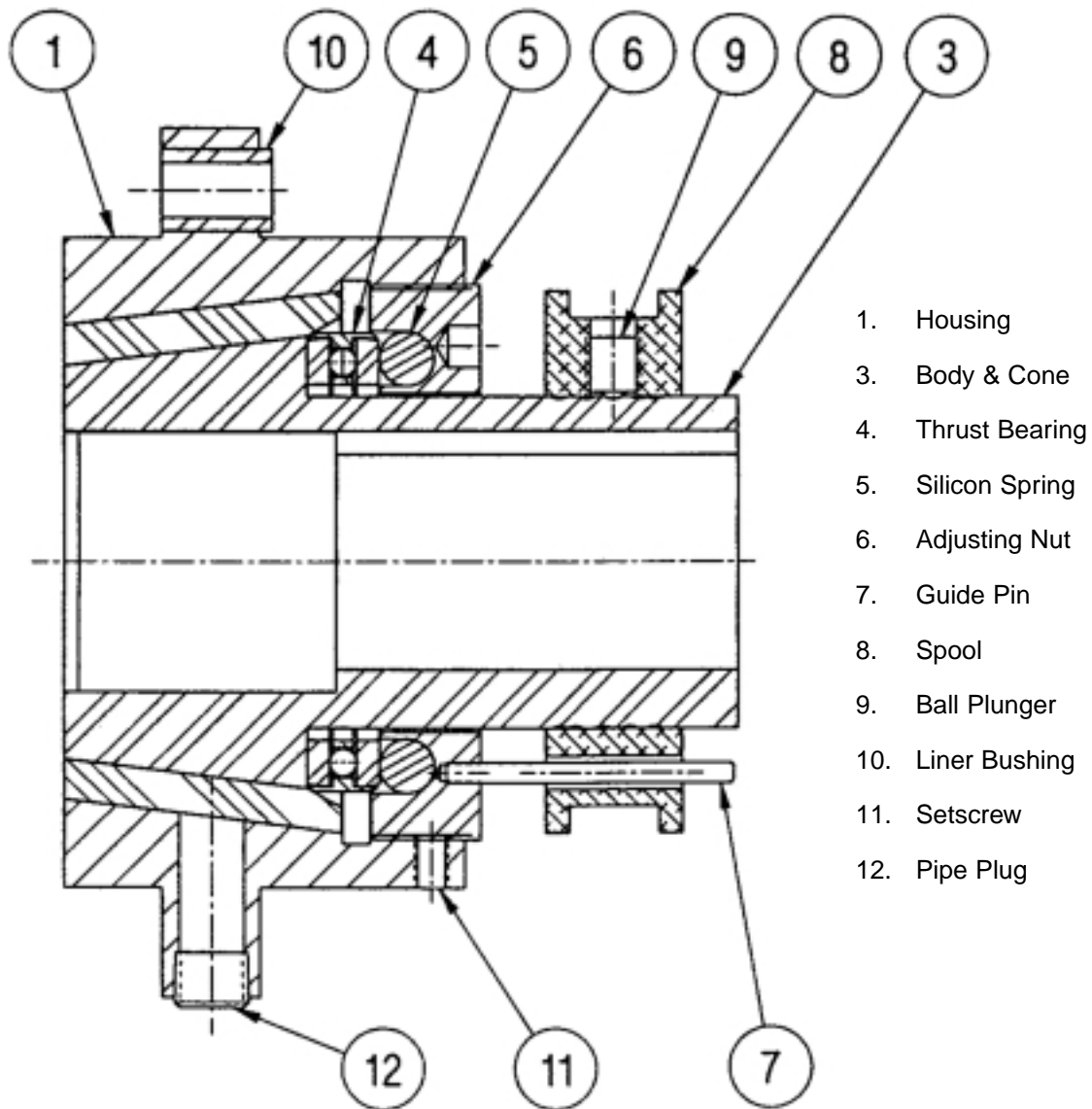


FIGURE 14

SECTION 5: Adjustments (continued)

5.3.1. Clutch Adjustment Description

The clutch must be adjusted to prevent any slippage during normal operation to prevent shock loading. It should also not be adjusted so tight as to be able to damage the indexer during a jam or overload. However, it is best to err on the side of being tighter than required. The proper setting for the clutch is determined by gradually tightening the clutch adjusting nut until the clutch no longer slips in either direction during a complete, fully loaded index cycle at normal speed.

5.3.2. Shut-off Spool Use & Adjustment

The shut-off spool (number 8, Figure 14) is attached to body and cone (number 3, Figure 14) by means of shallow round threads in body and cone (number 3, Figure 14) and a ball plunger (number 9, Figure 14) in spool (number 8, Figure 14). When the clutch is operating normally (i.e. not slipping), there is no relative movement between spool (number 8, Figure 14) and main body (number 3, Figure 14) and the remainder of the clutch, including the spool (number 8, Figure 14) driven by pin (number 7, Figure 14). This relative rotation causes the spool to move along the screw threads on the body (number 3, Figure 14). The spool will move to the left or to the right, depending on the rotation of the clutch. This lateral movement of the spool is intended to activate a limit switch arm located in the center groove in the spool. The "tripped" limit switch should be electrically connected to the controls to stop the operation of the motor driving the indexer.

To recover from a jam or overload in which the clutch has slipped sufficiently to displace the shut-off spool:

Manually disconnect the power to the drive motor to prevent an accidental start-up (use O.S.H.A. approved lockout procedures), clear the cause for the overload. Then simply push or pull the spool (number 8, Figure 14) on the main body (number 3, Figure 14) to the thread engagement which is closest to the center position on the threaded portion of the body (number 3, Figure 14). Check the limit switch circuitry for proper operating conditions. The indexer can now be powered up and production resumed.

SECTION 5: Adjustments (continued)

5.3.3. Clutch Adjustment Procedure

CAUTION: OPERATING THE INDEXER WITH THE CLUTCH NOT ADJUSTED CAN CAUSE IMMEDIATE AND SEVERE DAMAGE TO THE INTERNAL COMPONENTS OF THE INDEXER.



FIGURE 15

- a. Loosen cone point setscrew (number 11, Figure 14).
- b. Insert pins of spanner (figure 15) into holes of adjusting nut (number 6, Figure 14), and turn nut clockwise one notch in the adjusting nut. This will tighten the clutch.

NOTE: For heavy indexing loads or clutches on large units, it may be necessary to increase the length of the spanner wrench to gain more leverage.

If clutch has not been adjusted for a long period of time, it may be necessary to turn the nut counter-clockwise several turns, and tap the face of housing (number 1, Figure 14) towards the indexer with a rubber mallet to separate (loosen) the tapers. Take note of the number of loosening turns so the adjusting nut can be re-tightened to its original position.

- c. Re-tighten setscrew (number 11, Figure 14) making sure it engages in adjusting nut (number 6, Figure 14) to prevent damage to screw threads.

NOTE: If setscrew (number 11, Figure 14) is accidentally tightened on threaded portion of adjusting nut (number 6, Figure 14), it will raise a burr. Failure to remove this burr will cause shearing of threads and jamming of nut of housing (number 1, Figure 14). To remove burr, remove setscrew (number 11, Figure 14) and rotate adjusting nut counter-clockwise until burr is in center of tapped hole in housing (number 1, Figure 14). Use a hand electric drill that fits freely into the tapped hole. Drill into the adjusting nut (number 6, Figure 14) sufficiently to remove the burr.

There are (2) setscrews (number 11, Figure 14). They are positioned so one screw is half way between the slots in the nut when the other screw engages the slot in the nut. This is to allow for fine adjustment of the clutch. DO NOT use both screws at the same time as one screw will not be over a slot and will cause damage to the screw threads.

SECTION 5: Adjustments (continued)

- d. Apply power to the unit and check for clutch slippage.

NOTE: When clutch is not slipping, entire clutch will rotate as a single unit. When clutch is slipping body and cone (number 3, Figure 14) will not rotate with the other parts of the clutch. Small amounts of clutch slippage can be difficult to determine. To aid in providing if the clutch is slipping, use a grease pencil or felt tip marker and draw a line across face of nut (number 6, Figure 14) and along body (number 3, Figure 14). If clutch is slipping, the line on nut (number 6, Figure 14) and body (number 3, Figure 14) will move relative to each other.

DO NOT LET CLUTCH SLIP ANY LONGER THAN NECESSARY OR CLUTCH MAY HEAT UP RESULTING IN UNPREDICTABLE OPERATION AFTER IT COOLS.

- e. Repeat steps a through d until there is positively no clutch slippage.

5.3.4. Lubrication:

- a. Clutches are grease packed at the factory and should not require additional lubrication. If clutch is subject to consistent slippage and heating, remove pipe plug (number 9, Figure 14) and insert your standard grease fitting, lubricate with Lithium EP grease. Do not use air pressure gun!

SECTION 6: Maintenance

6.1. Correct Lubricants – For the protection of the unit use only lubricants meeting the specifications shown below in Chart 2. If you have any questions about a particular lubricant feel free to call us at 1-800-645-5207 or 847-459-5200.

6.2. Changing Oil

6.2.1. All parts are oil splash lubricated except for isolated areas where grease fittings will be supplied.

6.2.2. Maintain oil to the midpoint of the sight gauge or oil level & fill plug.

NOTE: The orientation of your unit will determine the exact quantity of oil required.

6.2.3. Drain, flush and fill the unit in intervals of 2400 hours or at least yearly. If drive operates at speeds above 300 RPM or at temperatures above 140 degrees F., increase oil change frequency to 6 months or 1200 hours intervals.

NOTE: When draining the oil observe for metal particles. This is an indication of excessive wear and the source of this wear must be determined.

6.2.4. Service all grease fittings on 1-month intervals or every 200 hours of operation.

NOTE: In the majority of the applications, grease fittings are not supplied since oil splash supplies the lubrication. Should grease be specified use Lithium No.2.

Indexer Oil:	Use SAE 90 EP Gear oil or equivalent meeting MIL-PRF-2105E and API Service Classification GL5 or GL6. For example, Mobilube HD 80W-90.
Capacity:	See specifications in Chart 1 for your model.
Gear Oil:	Bronze Gear Reducer oil requires SAE 140 Steam Cylinder Oil, meeting AGMA #8 Compound, MIL SPEC. MIL-L-15016A; symbol 3150 (Or manufacturer's specified oil if not a Industrial Motion Control manufactured reducer.)
Capacity:	See specifications in Chart 1 for your model.

CHART 2

SECTION 7: Troubleshooting

TROUBLESHOOTING GUIDE

Symptom	Cause	Solution
Backlash at output shaft (in dwell)	Worn/damaged followers	Replace
Tight Stations (torque required to rotate cam shaft through tight station is more than 1 1/2 times the loose station)	Bent cam followers	Replace; inspect holes in roller gear shaft
Pitting of cam follower outer race/ cam track surface	Incorrect oil	Replace cam followers and fill unit with correct oil
Fine magnetic metallic particles in oil; appear bronze color when in oil	Steel and iron worn from bearing roller ends and cages (this is a normal condition)	Flush out when replacing oil
REDUCER: Excessive Backlash	A. End play in worm shaft	Contact Technical Services at 800-645-5207 or 847-459-5200
	B. Loose gear on camshaft	Contact Technical Services at 800-645-5207 or 847-459-5200
Overheating in Excess of 210°F	A. Worm shaft bearing preload	Contact Technical Services at 800-645-5207 or 847-459-5200
	B. Incorrect alignment of worm and gear	Contact Technical Services at 800-645-5207 or 847-459-5200
	C. Excessive worm speed	Reduce worm speed

SECTION 7: Troubleshooting (continued)

TROUBLESHOOTING GUIDE

Symptom	Cause	Solution
OIL LEAKS AT: Seals	Worn or damaged seal and/or shaft surface	Replace seal; polish shaft
Shims	Damaged shim	Replace; apply "Loctite Aviation Grade Sealant" to both sides
Cap Screws	Shim damaged between screw hole and interior of housing	Replace gasket or shim; apply "Loctite Aviation Grade Sealant" to both sides
	Holes drilled through	Remove screw, apply "Loctite Threadlocker" and re-install
Cover joints	Inadequate sealant	Remove, clean and reassemble with silicone rubber sealant
Oil service pipe fittings	Not properly sealed	Remove, clean and reinstall with "Loctite Teflon Pipe Sealant"

NOTE: In the event that damage is found, it is recommended that the unit be returned to the factory for repair or that an Industrial Motion Control Serviceman make or supervise repairs in your plant. Proper alignment and adjustment of the components are essential to their performance and life.

SECTION 8: Repair and Replace

8.1 Cam Follower Replacement – Models ED90, ED91, & ED200.

- 8.1.1. Drain oil & rotate the input shaft so that indexing cam is approximately in center of dwell position. (See Figures 5 and 6)
- 8.1.2. Remove locknut on bottom of output center shaft (except ED91).
- 8.1.3. Remove roller gear hub shaft and center shaft as an assembly from housing.
- 8.1.4. Remove and replace followers following procedures outlined in Figures 16, 17, or 18 and continue with step 5.
- 8.1.5. Install roller gear hub shaft and center shaft assembly into housing. Care must be taken to insure proper alignment with locating pin. Apply an anaerobic type sealer between flange on center shaft and housing to form an oil tight seal.
- 8.1.6. Install locknut and tighten securely (except ED91).
- 8.1.7. Install new oil seal on outer flange of roller gear shaft, if necessary.
- 8.1.8. Refill with oil to level indicated.

8.2. Cam Follower Replacement – Models PN300, PN400, PN500, ED420, ED810, ED1440, & ED3240.

- 8.2.1. Drain oil and remove front access cover.
- 8.2.2. Rotate camshaft so cam follower is directly below access opening.
- 8.2.3. Remove and replace followers following procedures outlined in Figures 16, 17, or 18. Rotate camshaft until entire set has been changed and continue with step No.4.
- 8.2.4. Scrape old sealant from housing and access cover.
- 8.2.5. Apply new silicone rubber sealant and assemble front cover to housing. Tighten all screws evenly.
- 8.2.6. Refill with oil to level indicated.

SECTION 8: Repair and Replace (continued)

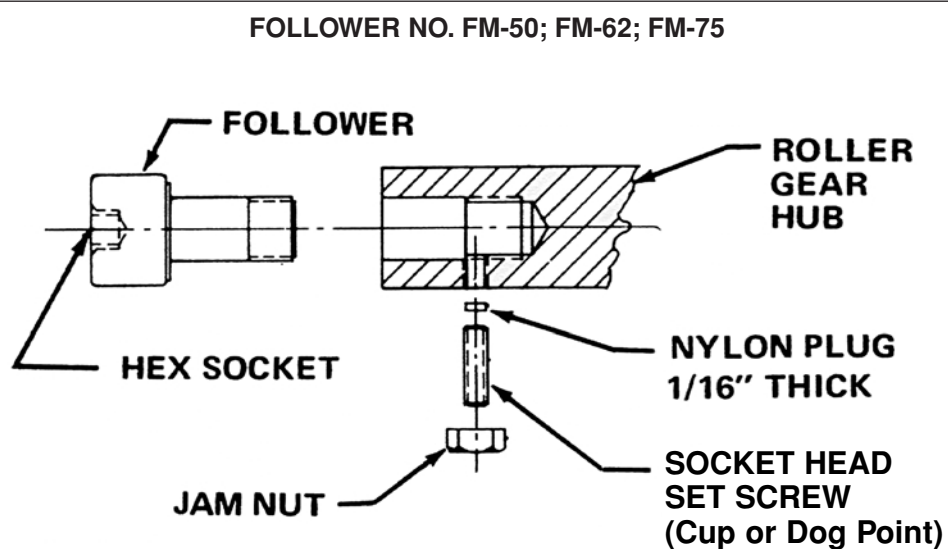


FIGURE 16

DISASSEMBLY:

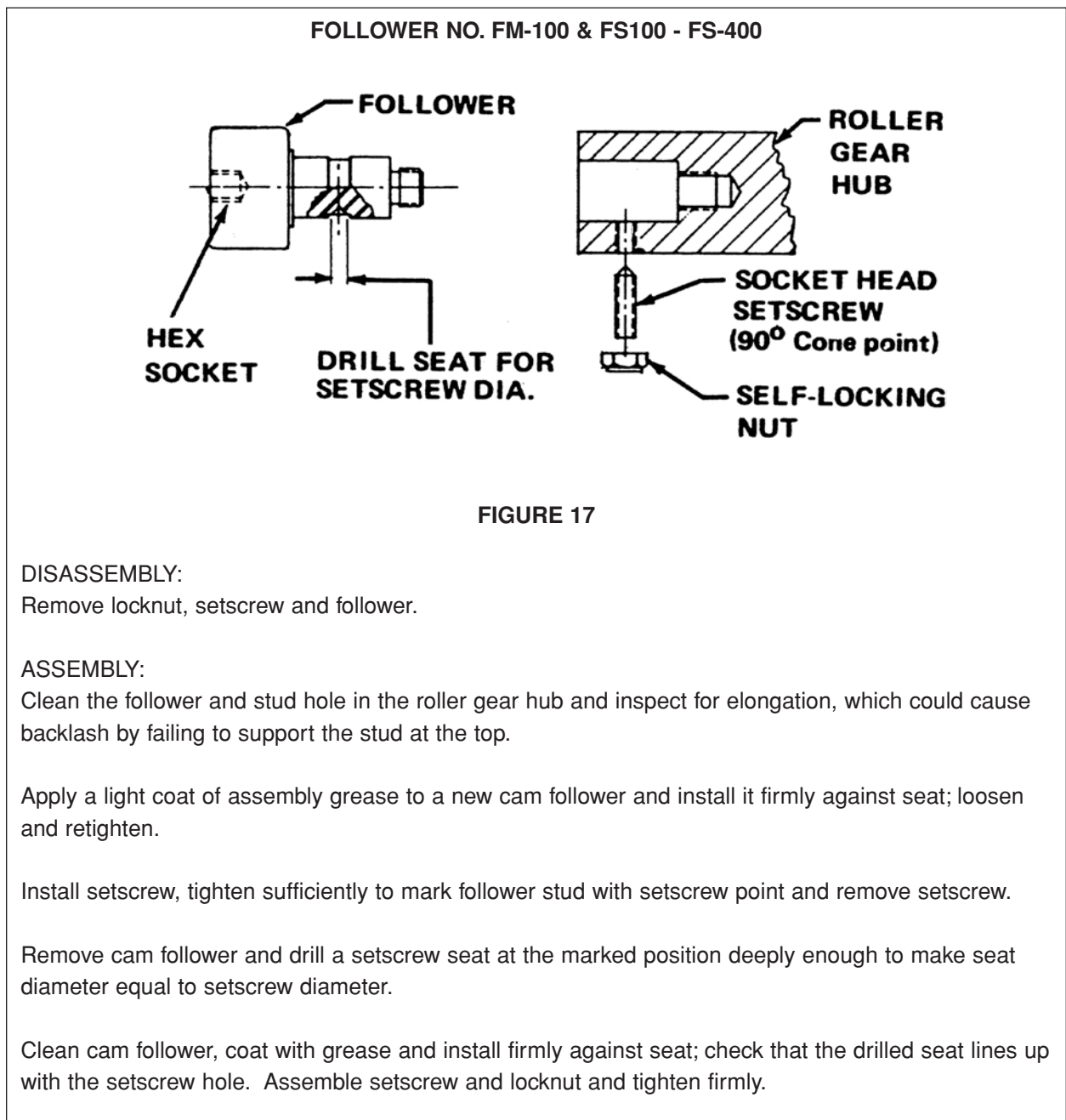
Remove jam nut, setscrew, follower and nylon plug.

ASSEMBLY:

Clean the follower stud hole in the hub and inspect for an out-of-round condition, which could cause backlash by failing to support the stud at the top.

Apply a light coat of assembly grease to a new cam follower and install it firmly against seat; loosen and retighten. Install new nylon plug and tighten setscrew and jam nut in place.

SECTION 8: Repair and Replace (continued)



SECTION 8: Repair and Replace (continued)

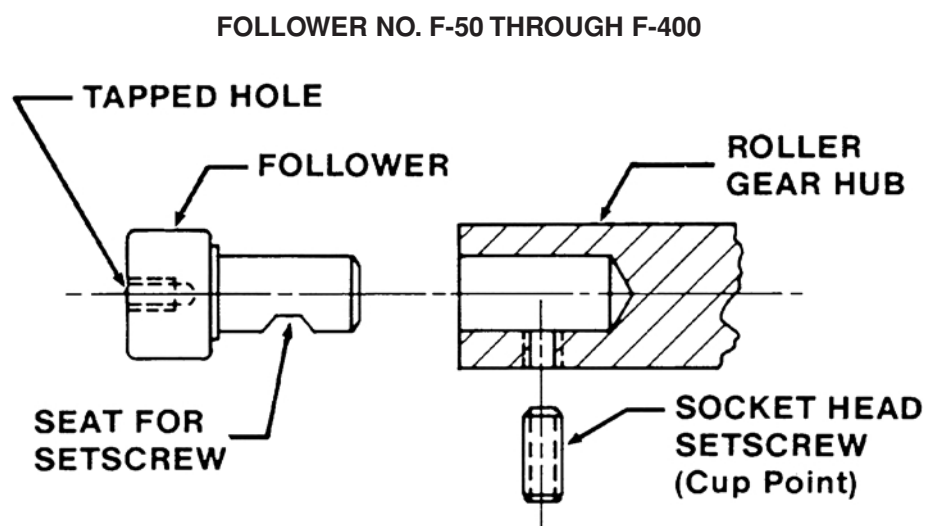


FIGURE 18

DISASSEMBLY:

Remove setscrew and pull cam follower from hole using a draw hammer secured in tapped hole.

ASSEMBLY:

Clean the follower stud hole in the roller gear hub and inspect for elongation, which could cause backlash by failing to support the stud at the top.

Place a socket head screw in pull hole and strike its head - do not strike the follower end cap when installing.

Apply a light coat of assembly grease to a new cam follower, orient so the setscrew and seat are in line and install lightly against shoulder.

Place a drop of No. 222 grade Loctite® on setscrew, install and tighten firmly.

SECTION 8: Repair and Replace (continued)

8.3. Oil Seal Replacement

- 8.3.1. Remove oil seals by drilling a number of holes into the seal case. The seal may then be removed with a pointed tool. Be sure to remove all metallic chips created during the drilling of removal holes.
- 8.3.2. Check dimensions – to be sure that shaft and bore diameters match those specified for the seal selected.
- 8.3.3. Check seal – for damage that may have occurred prior to installation. A sealing lip that is turned back, cut or otherwise damaged should be replaced.
- 8.3.4. Check bore – to see that the leading edge is deburred, A rounded corner or chamfer should be provided.
- 8.3.5. Check shaft – remove surface nicks, burrs and grooves and look for spiral machine marks that can damage the seal lip.
- 8.3.6. Check shaft end – remove burrs or sharp edges. The shaft end should be chamfered.
- 8.3.7. Check splines and keyways – smooth any sharp edges and when necessary protect the seal lip with an assembly sleeve or shim stock. Round the edges of the spline or keyway as much as possible and lubricate with a hard, fibrous grease.
- 8.3.8. Check seal direction – make sure that the new seal faces in the same direction as the original. Generally, the lip faces the lubricant or fluid to be sealed.
- 8.3.9. Pre-lubricate the sealing element before installation by wiping with lubricant being retained.
- 8.3.10. Use the correct installation tool – press-fitting tools should have an outside diameter .010" smaller than the bore size. If possible, the center of tool should be relieved so that pressure is applied only at the O.D.
- 8.3.11. Use proper driving force – where possible, an arbor press; otherwise, a dead blow hammer to avoid popping the spring out of the seal. NEVER HAMMER DIRECTLY ON THE SURFACE OF THE SEAL.

SECTION 8: Repair and Replace (continued)

8.3.12. Bottom out the tool or seal – to avoid cocking of the seal in the bore. This also positions the seal correctly on the shaft.

8.3.13. Check for parts interference – from other machine parts that might rub against the seal causing friction and damaging heat.

8.4. Reducers

TYPICAL FERGUSON “R” SERIES REDUCER

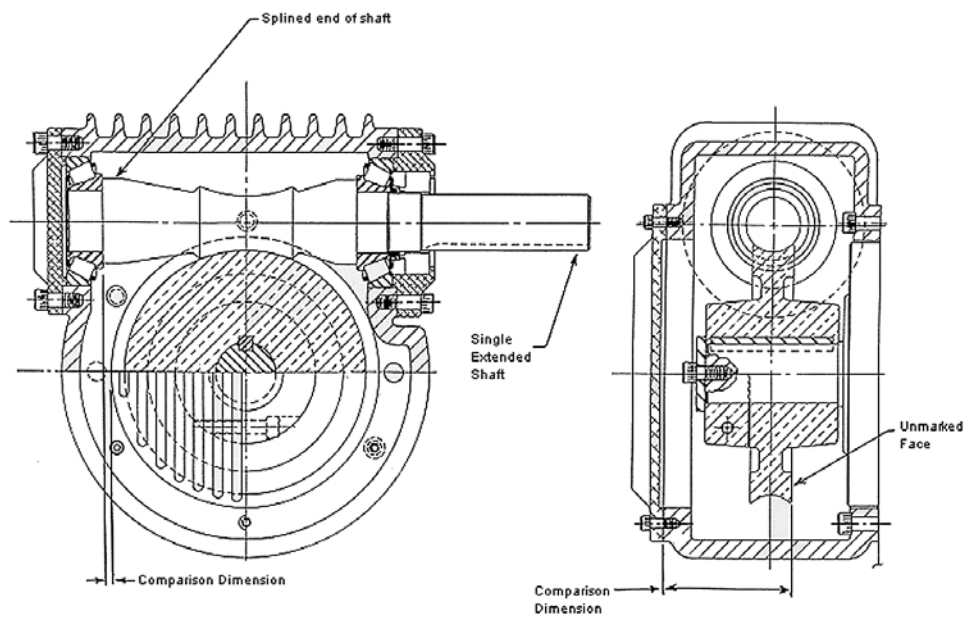


FIGURE 19

SECTION 8: Repair and Replace (continued)

8.4.1. "R" Series (Ferguson) Reducers

NOTE: The "R" Series reducer is a double enveloping worm gear type with components manufactured to Industrial Motion Control's specifications by selected vendors. The worm and gear are provided in matched sets with minimal backlash and installed in housings of Industrial Motion Control's design.

The identifying number of a reducer consists of the letter "R" followed by a number and a two-digit number (i.e. R4 15). The "4" indicates the center-to-center distance between the worm and the gear; the "15" reflects the reduction ratio. In this example, the ratio is 15:1.

8.4.1.1. Component Removal

8.4.1.1.1. Worm Shaft.

8.4.1.1.1.1. Drain oil and remove cover plate.

8.4.1.1.1.2. Record the distance between the worm bearing shoulder on the splined end of the shaft (opposite the single extension end of the shaft) to the finished bore on the cover side (see Figure 19).

8.4.1.1.1.3. Remove screws and worm bearing caps, keeping each set of shims with their respective bearing caps.

8.4.1.1.1.4. Tap the worm shaft back and forth axially to move the outer race of the supporting bearings out of position.

8.4.1.1.1.5. Shift the worm to the side of the housing, clear of the gear. Remove the worm through the bearing bore in the housing.

SECTION 8: Repair and Replace (continued)

NOTE: Worm must be dropped before attempting to remove the gear.

8.4.1.1.2. Gear

8.4.1.1.2.1. Remove the worm as described above.

8.4.1.1.2.2. Record the distance from the finished face of the housing to the unmarked face of the gear (see Figure 19).

8.4.1.1.2.3. Remove screw and washer retaining gear, if applicable.

8.4.1.1.2.4. Loosen the screw clamp on the split hub side of the gear.

8.4.1.1.2.5. Remove the gear. Tapped holes in the end of the gear hub may be utilized in conjunction with a puller.

8.4.1.1.3. Component Replacement

NOTE: If both worm and gear were removed from the housing, the gear must be replaced before the worm shaft is installed.

8.4.1.1.3.1. The correct relationship of the worm and gear must be maintained when reassembling the components. Regardless of the actual position of the reducer unit on the roller gear drive or Intermittor housing, you must imagine that the worm is over the gear and that you are viewing the worm from the single extension end (the end opposite of the splines on the worm shaft) with the unmarked face of the gear to your right. Maintain this relationship between components when installing the gear on the roller gear camshaft.

SECTION 8: Repair and Replace (continued)

- 8.4.1.1.3.2. The distance from the finished face of the housing to the unmarked face of the gear, noted at the time of disassembly, must be duplicated, either by grinding the adjusting spacer or adding shims (see Figure 19).
- 8.4.1.1.3.3. Tighten the clamp screw in the split hub of the gear and assemble the gear retaining screw and washer, if such were provided as part of the factory installation.
- 8.4.1.1.3.4. Press cones of the tapered bearings onto the worm shaft and insert the worm shaft in the housing.
- 8.4.1.1.3.5. Assemble bearing cups, shims and caps and establish pre-load, 2 IN-LBS, .003 SHIM. Adjust shims under bearing cups until the dimension between the worm bearing shoulder and the finished housing bore, as recorded at the time of disassembly, is duplicated (see Figure 19).

NOTE: Do not discard any of the shims. Make adjustments in pre-load by shifting shims from one bearing cup to the other.
- 8.4.1.1.3.6. Replace cover plate and refill with oil. Refer to Chart 1 & 3 for quantity and specification.

8.4.2. Winsmith Worm Gear Reducer

NOTE: Due to its modular and hollow shaft design, it is not considered economical to replace components only in these reducers. Except for seal or other oil leak problems, replacement of entire reducer is recommended.

SECTION 9: THINGS TO AVOID

An Industrial Motion Control Indexer is a relatively simple mechanism using an input shaft mounted, tapered, ribbed barrel cam to drive roller followers on the output hub. While simple in concept, the precision nature of the indexer's manufacture indicates that they must be used within their design constraints. The indexer is, after all, just a mechanical device. In this regard there are several situations which should be avoided to protect your warranty and maximize indexer life.

Off-center loading, such as might be seen when a large press is used in conjunction with an indexer, requires a back-up support anvil under the dial. The bearings of an indexer are very heavy duty, but their life will be shortened dramatically by unsupported, asymmetrical loading. The support anvil is typically designed with .001" of clearance under the dial and is strong enough to carry the full load of the asymmetrical load. Consult Industrial Motion Control Technical Sales Department at 1-800-645-5207 or 847-459-5200 for assistance in all asymmetrical load situations.

E-Stop Usage should be limited to emergency situations only. E-Stops should not be used to jog an indexer. The E-Stop function causes extreme load conditions inside the indexer by virtue of the instantaneous stopping of significant weights. This is not unlike driving a car into a brick wall. Excessive use of the E-Stop will significantly shorten the life of the indexer.

Starting and Stopping while in the motion profile of the cam will also put high loading on the indexer's internal components. Should it be necessary to stop/start the indexer in any position other than the dwell of the cam, it is best to reduce motor speed to avoid overloading the unit.

Shock Loading may also lead to problems. Shock loading typically occurs when there is looseness in the input drive train or where the output load is not stable. This condition will eventually damage either the indexer's followers or cam. Overload devices, that are not set correctly, are sometimes a source of this condition. Chain drives or loose timing belt drives are also potentials.

Machine Jams, like E-Stops, put excessive loading on an indexer. While the impact of jams is minimized by the use of overload devices, it is always best to track the occurrence of jams and, when possible, rectify the condition that led to the jam. A high jam frequency will shorten indexer life.

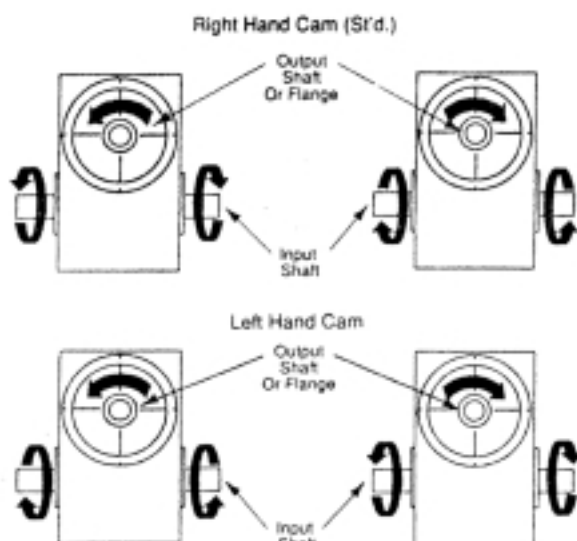
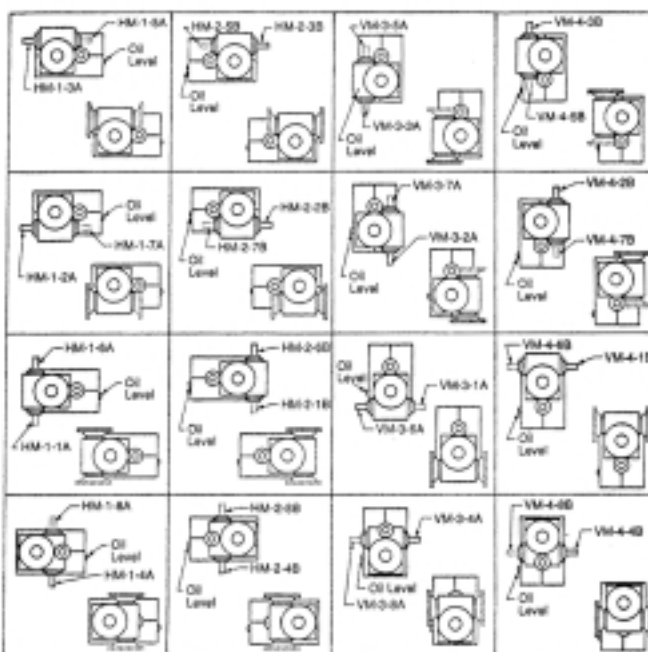
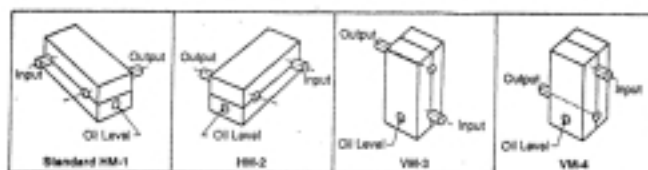
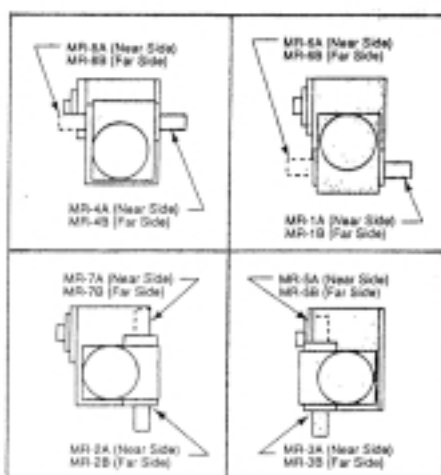
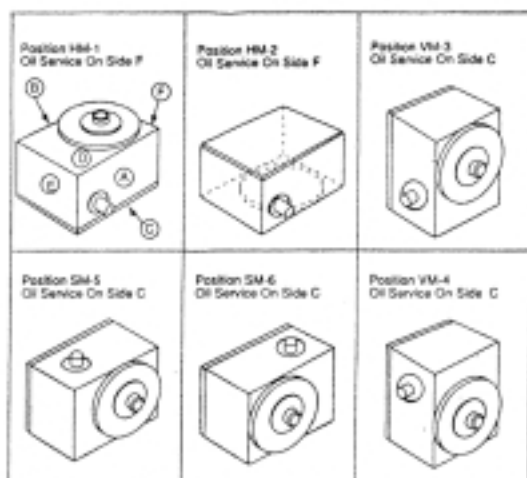
SECTION 9: THINGS TO AVOID (continued)

Friction from any source adds to the load of an indexer. This can include cam driven mechanisms and/or additional, ancillary devices driven off the indexer's drive shaft or output. Extreme build-up of contamination or other sources of interference adds to the frictional load. Industrial Motion Control indexers handle frictional loads very well, but the loading must be evaluated in terms of the indexer's overall capacity to ensure that the life of the equipment will not be compromised.

IMPROPER LUBRICATION CAN RESULT IN IMMEDIATE CATASTROPHIC FAILURE OF THE UNIT.

Contact Industrial Motion Control Technical Sales Department (1-800-645-5207 or 847-459-5200) or your local Sales Engineer for assistance when evaluating the above conditions.

UNIT CONFIGURATIONS, REDUCER MOUNTING POSITIONS, HAND OF CAM



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